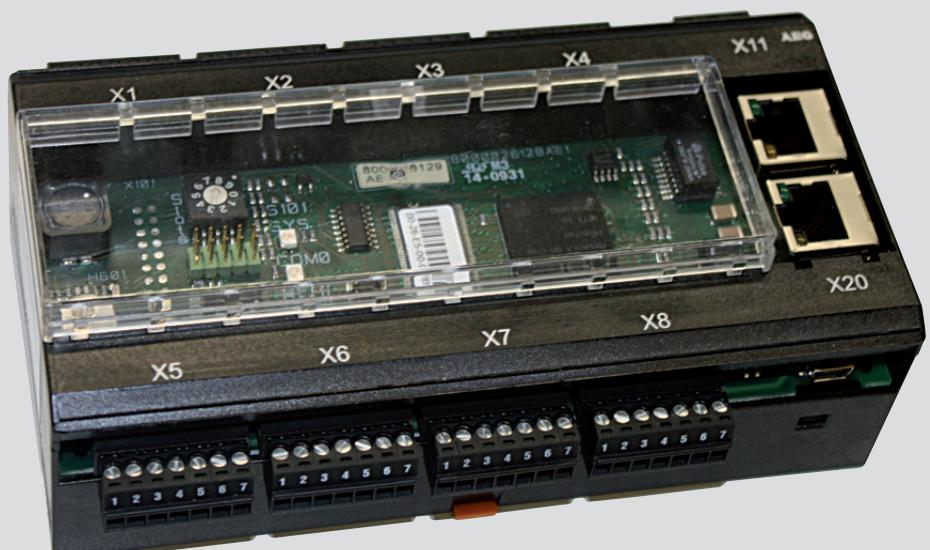


# Ethernet Bus Module Profinet



- Thyro-S ...H1, ..HRL1
- Thyro-A ...H1, ..HRL1, ..HRLP1
- Thyro-A ...C01, ..C02, ..C03, ..C05, ..C07
- Thyro-Power Manager
- Thyro-Step Controller
- Thyro-Measurement Unit

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# Contact

## **Technical queries**

Do you have any technical queries regarding the subjects dealt with in these operating instructions?

If so, please get in touch with our team for power controllers:

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# 1. Introduction

The operating instructions below serve only as an addition to be used in conjunction with the operating instructions of the AEG Power Solutions Thyro-A power controller, Thyro-S power switch, and Thyro-Power Manager in the versions of the types indicated on the covering page. The safety instructions contained therein are to be observed in particular.

## 1.1 General

The Ethernet bus module can connect up to 8 power controllers of type Thyro-A and type Thyro-S with a master in any desired order.

Several bus modules can be used on one system.

The power supply of the bus module comes from an external 24V DC voltage source (150mA), which is to be fed in (reverse polarity protected) at X11.1 (+) and X11.2 (ground). Several modules can be operated from one power supply.

As short a ground connection as possible is needed at terminal X11.3 for EMC reasons.

## 1.2 Special features

- The Ethernet bus module connects the devices with several Ethernet bus systems. By setting the "Protocol" switch to 0, the Ethernet bus module becomes a Profinet IO-device.
- function control via LED
- 8 free application outputs X1 to X8 in each case terminal 5
- C-rail assembly

## 1.3 Type designation

Ethernet bus module Profinet order-no. 2000 000 846

## 1.4 Abbreviations

AEG PS	AEG Power Solutions GmbH
TPM	Thyro – Power Manager
TSC	Thyro – Step Controller
TMU	Thyro – Measurement Unit
TIO	Thyro Input / Output Unit

## 1.5 Warranty

In the event of any claims in connection with the Ethernet bus module, please contact us quoting:

- type designation
- fabrication number / serial number
- reason for the complaint
- environmental conditions of the device
- operating mode
- period of use

Goods and services are subject to the general conditions of supply for products of the electrical industry, and our general sales conditions. Claims in connection with supplied goods must be submitted within one week of receipt, along with the delivery note. AEG PS will rescind all obligations such as warranty agreements, service contracts, etc. entered into by AEG PS or its representatives without prior notice if maintenance and repair work is carried out using anything other than original AEG PS spare parts or spare parts purchased from AEG PS.

## 2. Safety

### 2.1 Identification in the operating instructions

In these operating instructions, there are warnings before dangerous actions. These warnings are divided into the following danger categories:



#### DANGER

Dangers that can lead to serious injuries or fatal injuries.



#### WARNING

Dangers that can lead to serious injuries or considerable damage to property.



#### CAUTION

Dangers that can lead to injuries and damage to property.

#### CAUTION

Dangers that can lead to minor damage to property.

The warnings can also be supplemented with a special danger symbol (e.g. „Electric current“ or „Hot parts“), e.g.



risk of electric current or



risk of burns

In addition to the warnings, there is also a general note for useful information.



#### NOTE

Content of note

### 2.2 General danger information



#### DANGER

Not adhering to the safety stipulations in the operating instructions of the power controllers used can lead to danger of injury / danger of damaging the device or system.

> Adhere to all safety stipulations in the chapter “Safety” of the operating instructions of the power controllers being used.



#### DANGER

##### Electric current



Risk of injury from current carrying parts / danger of damaging the bus module.

> Never operate the device without the covering.

> Undertake settings and wiring without current being supplied



#### CAUTION

Danger of damaging the bus module

The current at terminals X1.5 to X8.5 must not exceed 120 mA.

> Check the connection information of the preceding relay.



#### NOTE

Communication errors

To avoid communication errors please note the following points:

- > Use shielded cables.
- > Undertake grounding of the bus module (X1.7 to X8.7). Do not ground additionally at the power controller.

### 2.3 Operator requirements

The operator must ensure the following:

- The safety regulations of the operating instructions are observed.
- The accident prevention regulations valid in the respective country of use and the general safety regulations are observed.
- All safety devices (covers, warning signs etc.) are present, in perfect condition and are used correctly.
- The national and regional safety regulations are observed.
- The personnel has access to the operating instructions and safety regulations at all times.
- The operating conditions and restrictions resulting from the technical data are observed.
- Should abnormal voltages, noises, increased temperatures, vibration or similar occur, the device is immediately put out of operation and the maintenance personnel is informed

### 2.4 Personnel requirements

Only qualified electro-technical personnel who are familiar with the pertinent safety and installation regulations may perform the following:

- transport
- installation
- connection
- commissioning
- maintenance
- testing
- operation

These operating instructions must be read carefully by all persons working with or on the equipment prior to installation and initial start-up

### 2.5 Intended use

The device may only be used for the purpose for which it was intended, as persons may otherwise be exposed to dangers (e.g. electric shock, burns) and plants also (e. g. overload). The user must therefore observe the following points:

- It is not permitted to make any unauthorized modifications to the unit or to use any spare parts or replacement parts not approved by AEG PS, or to use the unit for any other purpose.
- The warranty obligations of the manufacturer are only applicable if these operating instructions are observed and complied with.
- The device is a component that cannot function alone.
- Project planning must account for the proper use of the device.

### 2.6 Use of the device

#### 2.6.1 Operation

- Only switch on the mains voltage at the device when there is no danger to persons, system or load.
- Protect the device against dust and damp.
- Ensure that the ventilation openings are not blocked.

## **2.6.2 Prior to installation / commissioning**

- If stored in a cold environment: ensure that the device is absolutely dry. (Allow the device a period of at least two hours to acclimatize before commissioning)
- Ensure sufficient ventilation of the cabinet if mounted in a cabinet.
- Observe minimum spacing.
- Ensure that the device cannot be heated up by heat sources below it. (see page 33, Technical data).
- Ground the device in accordance with local regulations.
- Connect the device in accordance with the connection diagrams.

## **2.6.3 Maintenance, service, faults**

In order to avoid personal and material damages, the user must observe the following:

- Before all work:
  - > Disconnect the device from all external voltage sources.
  - > Secure the device against accidentally being switched back on.
  - > Use suitable measuring instruments and check that there is no voltage present.
  - > Ground and short circuit the device.
  - > Provide protection by covers or barriers for any neighboring live parts.
- The device may only be serviced and repaired by trained electro-technical personnel.

## **2.6.4 Transport**

- Only transport the device in the original packaging.
- Protect the device against damage, caused by jolts, knocks and contamination, for instance.

### 3. Functions

#### 3.1 Processing the setpoint Thyro-S

##### Only local setpoints, no bus setpoint

Switching signal (24DC) at the control terminal X22.1 of the Thyro-S

> No wiring of the terminal point X22.4 at the power controller

- The bus module is fully functional. The analog signal from the control terminal X22.1 is used as setpoint (on/off).

##### Setpoint from the bus module (X22.3), no local setpoint

> Connect the ground to terminal X22.4 of the power controller.

- The master setpoint of the bus module is used. For this purpose the setpoint is interpreted as the operating mode.

##### Bus setpoint, switching over to „local“ in case of bus fault

Only use the setpoint of the bus module if there is an IO connection.

> Connect terminal X22.4 of the power controller to one of the terminals X1.1 to X8.1 of the bus module.

- If there is an IO connection the master set point is used.

If not then the analog signal from the control terminal X22.1 is used as setpoint (on/off).

##### Switching over to bus / local setpoint switchable for each controller in operation

Individual setpoint from the bus module for each power controller.

> Connect terminal X22.4 of the power controller to one of the terminals X1.5 to X 8.5 of the bus module.

- The power controllers can be switched over individually (targeted) via the bus between master setpoint and terminal X22.1

#### 3.2 Processing the setpoint Thyro-A

##### Only local setpoints, no bus setpoint

Analog input at control terminal X2.4 of Thyro-A

> Do not connect anything to terminal X22.1 of the power controller.

- The bus module is fully functional. The analog signal from the control terminal X2.4 is used as setpoint (on/off).

##### Setpoint from the bus module (X22.3), no local setpoint

> Connect the ground to terminal X22.1 of the power controller.

- The master setpoint of the bus module is used.

##### Bus setpoint, switching over to “local” in case of bus fault

Only use the setpoint of the bus module if there is an IO connection.

> Connect terminal X22.1 of the power controller to one of the terminals X1.1 to X8.1 of the bus module.

- If there is an IO connection the master setpoint is used. If there is no IO connection then the analog signal from the control terminal X2.4 is used as setpoint.

##### Switching over to bus / local setpoint switchable for each controller in operation

Individual setpoint from the bus module for each power controller.

> Connect terminal X22.1 of the power controller to one of the terminals X1.5 to X8.5 of the bus module.

- The power controllers can be switched over individually (targeted) via the bus between master setpoint and terminal X2.4.

### 3.3 Processing the setpoint Thyro-Step Controller

#### Only local setpoints, no bus setpoint

Analog input at control terminal X6.1 or X6.4 (depending on X6.7) of the TSC

> Do not connect anything to terminal X2.1 of the power controller.

- The bus module is fully functional. The analog signal from the control terminal X6.1 or X6.4 is used as setpoint.

#### Setpoint from the bus module (X22.3), no local setpoint

> Connect the ground to terminal X2.1 of the TSC.

- The master setpoint of the Ethernet bus module is used.

#### Bus setpoint, switching over to “local” in case of bus fault

Only use the setpoint of the bus module if there is an IO connection.

> Connect terminal X2.1 of the TSC to one of the terminals X1.1 to X8.1 of the bus module.

- If there is an IO connection the master setpoint is used. If there is no IO connection then the analog setpoint is used.

#### Switching over to bus / local setpoint value switchable for each controller in operation

Individual setpoint from the bus module for each power controller.

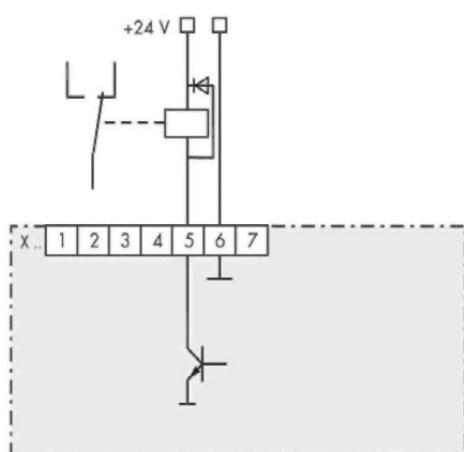
> Connect terminal X2.1 of the power controller to one of the terminals X1.5 to X8.5 of the bus module.

- The power controllers can be switched over individually (targeted) via the bus between master setpoint and the analog setpoint.

### 3.4 Freely addressable digital outputs

- > As long as the terminals X1.5 to X8.5 of the bus module are not being used for switching over the setpoint, these can be used as switch outputs.
- > Connect the relay to a 24 V DC coil voltage for free use. The idle circuit is integrated. The actuating current is a maximum 120 mA per output. As a result it is possible to switch over, for example, the room ventilators, anti-condensation heating, circuit breakers or control lamps via the bus.

#### Relais Control



## 4. Installation



### DANGER

Dangers during Installation

Risk of injury / Risk of damage to the device or plant

Observe all safety regulations in the chapter "Safety".

### 4.1 Connection terminals (overview)

Tab.1 Connecting terminals (overview)

Terminal		Description
X11	.1	24V (+)
	.2	24V (ground)
	.3	grounding, carry out as short as possible
X1 - X8	.1	jointly switchable ground potential
	.2	RxD
	.3	TxD
	.4	ground
	.5	separately switchable ground potential
	.6	ground
	.7	ground potential for shield connection

Connection diagram see page 30.

### 4.2 Connecting a 24 V power supply

- > Switch off the main power supply including the external 24 V power source and make sure these cannot be accidentally switched back on again.
- > Connect the external 24 V voltage supply (150 mA) to X11.1 (+) and X11.2 (-) (reverse polarity protection).
- > Ground the X11.3 terminal by as short a route as possible (for EMC reasons).



### REMARK

24 V DC power source

Several bus modules can be operated with one power supply.

> In cases of SELV (safety extra low voltages) do not ground the 24 V power source.

### 4.3 Connecting the power controller to X1-X8

- > Switch off the main power supply including the external 24 V power source and make sure these cannot be accidentally switched back on again.
- > Connect the interfaces X1 to X8 of the bus module to the system interfaces of the power controller (shielded four-wire cable)

**Attention:** To control all parameters by ProfiNet we recommend closing the Thyro-A switches S1.3, S1.4, S1.5 (Thyro-Tool Mode).

### 4.4 Connecting the Ethernet bus module to the master

The Ethernet bus module has two Ethernet ports which are equipped with a switch functionality which allows a line topology to be constructed.

A standard patch cable is required for connecting with a switch. For a direct connection (line topology) a cross-over cable is required.

## 5. Settings

### 5.1 Setting the protocol

The Ethernet bus module supports various real time Ethernet bus systems. The desired system can be selected using the rotary switch "Protocol". For Profinet this needs to be set to 0.

### 5.2 Setting the number of slots

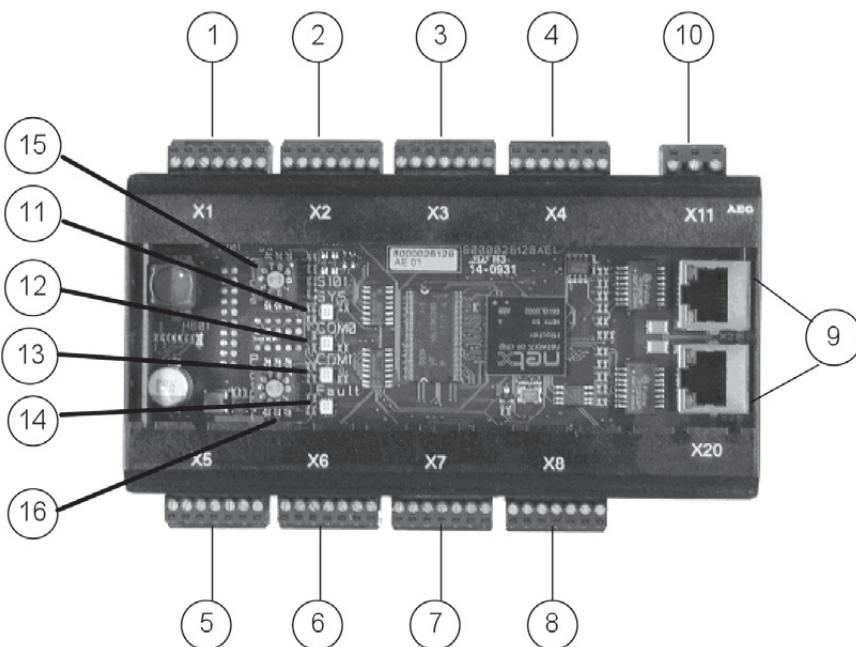
The number of devices which are connected to the Ethernet bus module is set with the rotary switch "Slots". After switching on, the Ethernet bus module reads all the parameters of the device. Following this it starts communicating.

**Attention:** To change the number of slots when switched on, the switch "Slots" must first be turned to 0. Communication with the master is then interrupted. Following this the desired number can be set. After leaving the position 0 you have about 2 seconds time for this.

### 5.3 Setting the device name

Every IO device is identified by its device name. The setting of the device name can be undertaken using, for example, the program "Step 7 – HW Config" in the menu "Target system / Ethernet / Edit Ethernet participant..."

**Fig. 1 Configuration & LED displays**



1 Terminal X1	10 Terminal X11
2 Terminal X2	11 SYS LED
3 Terminal X3	12 COM0 (BF) LED
4 Terminal X4	13 COM1 (SF) LED
5 Terminal X5	14 Fault LED
6 Terminal X6	15 Switch Slots
7 Terminal X7	16 Switch Protocol
8 Terminal X8	
9 Ethernet Port	

## 5.4 Operating display of the bus module

**Table 2 Operating display of the bus module**

LED	Color	Status	Meaning
SYS	Green	On	Operating system running
	Red	Flashing with 1Hz	Error in boot process
	Red	On	Waiting for boot process (check position of "Protocol" switch)
		Off	No supply voltage
COM0 (BF)	Red	On	No physical connection
	Red	Flashing with 2Hz	No data exchange
		Off	The device is exchanging data with the Profinet IO Controller
COM1 (SF)	Red	On	Watchdog time out or system error
		Off	No error
Fault	Red	On	Hardware error

### Operating status of the Ethernet bus module

LED	Color	Status	Meaning
Link	Green	On	There is an Ethernet connection
Activity	Yellow	On	Data are being exchanged via Ethernet

### Status LED of the Ethernet Ports

## 6. Operation

### 6.1 Start configuration (parameterization)

Via the parameterization (in step 7 – HW Config, double-click on slot 0 of the bus module, parameter tab) the following settings can be undertaken.

#### No connection (slot 1-8):

Here you can set what should happen with the output data of the devices if the connection to the master is interrupted.

<b>Hold last values</b>	The output data are not changed.
<b>Outputs = 0</b>	The output data are set to 0

#### No connection (slot 9):

Here you can set what should happen with the output data of the bus module if the connection to the master is interrupted.

<b>Hold last value</b>	The digital outputs are not changed.
<b>Outputs = 0</b>	The digital outputs are set to 0.

#### Averaging of the measured values:

Here you can enter the number of actual values which flow into the averaging. A new value is calculated once a second. Values from 0-20 can be entered, whereby 0 or 1 deactivates this function.

#### Remove device when it is switched off:

Not all devices are equipped with a 24 V supply connection. When switching off the Thyro mains supply and the control voltage supply (24V) the Thyro no longer communicates with the bus modules. A switched off device will normally be displayed as pull. This display can be suppressed here.

<b>Deactivate</b>	Devices which are no longer accessible (no communication) will continue to be displayed as plug.
<b>Activate</b>	Devices which are no longer accessible will be displayed as pull.

#### Use output data:

The suppression of certain output data can be activated here.

<b>Always</b>	New output data are transferred immediately.
<b>Only when Bit is set</b>	New output data are only transferred, if the Bit 0 is set in the output "Functions"

### 6.2 Cyclical data transmission (configuration)

The configuration of the cyclical data traffic is undertaken by adding modules.

The input and output data depend on the device types. The following tables show the input and output data available for each of the devices.

### 6.3 Input and output data Thyro-S

With the Thyro-S the setpoint is interpreted as operating mode.

**Tab. 3 Interpretation of the master setpoint with Thyro-S**

Setpoint (Master)	Status (return value)	(Total setpoint)
0 to 409	= OFF	0 =
410 to 1091	1/5	819
1092 to 1706	= 1/3	1365 =
1707 to 3071	1/2	2047
3072 to 4096	= ON	4096

**Tab. 4 Cyclic input and output data with Thyro-S ..H1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Mains voltage L1	integer	2	[V]
6	Total setpoint	integer	2	4096=100%
8	Fault (see table 5b)	integer	2	-
10	Status (see table 5b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master Setpoint	integer	2	4096=100%

**Tab. 5 Cyclic input and output data with Thyro-S ..HRL1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load current L1	float	4	[A]
8	Mains voltage L1	integer	2	[V]
10	Total setpoint	integer	2	4096=100%
12	Fault (see table 5b)	integer	2	-
14	Status (see table 5b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 5b Thyro-S Faults**

Description	Bit	LEDs	Relay
Frequency measurement outside of 47 Hz to 63 Hz	Bit 0	Test LED flashing slowly	open
SYNC error, no zero-crossing within the gate	Bit 1	Test LED flashing slowly	open
Temperature monitoring triggered	Bit 2	Load Fault flashing slowly	open
Load fault	Bit 3	Load Fault on	open
Flash values invalid	Bit 4	Test LED and Load Fault LED flashing simultaneously quickly	open
Mains undervoltage (<AD_P_SPG_MIN)	Bit 5	Load Fault LED and Test LED on	open
Mains overvoltage (>AD_P_SPG_MAX)	Bit 6	None	closed

**Tab. 5b Thyro-S Status**

Description	Bit	LEDs	Relay
Pulse inhib active (bridge X2.1-X2.2 open)	Bit 0	none	open
Mains frequency is 60Hz	Bit 2	none	open
Relay status (0=relay off / 1=relay on)	Bit 8	none	open
Device switched off	Bit 9	--	closed
Wrong device	Bit 10	--	----
Bus module active (0=no bus module / 1=bus module active)	Bit 11	none	----
Thyristor short-circuit	Bit 14	Test LED and Load Fault LED flashing alternately slowly	----

## 6.4 Input and output data Thyro-A

**Tab. 6 Cyclic input and output data with Thyro-A 1A...H1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Mains voltage L1	integer	2	[V]
6	Switch-on time TS	integer	2	[period]
8	Switch-on angle alpha	integer	2	[0.01 °el]
10	Total setpoint	integer	2	4096=100%
12	Fault (see table 14b)	integer	2	-
14	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 7 Cyclic input and output data with Thyro-A 1A...HRL1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load current L1	float	4	[A]
8	Mains voltage L1	integer	2	[V]
10	Switch-on time TS	integer	2	[period]
12	Switch-on angle alpha	integer	2	[0.01 °el]
14	Total setpoint	integer	2	4096=100%
16	Fault (see table 14b)	integer	2	-
18	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 8 Cyclic input and output data with Thyro-A 1A...HRLP1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load current L1	float	4	[A]
8	Power L1	float	4	[W]
12	Mains voltage L1	integer	2	[V]
14	Switch-on time TS	integer	2	[period]
16	Switch-on angle alpha	integer	2	[0.01 °el]
18	Total setpoint	integer	2	4096=100%
20	Fault (see table 14b)	integer	2	-
22	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 9 Cyclic input and output data with Thyro-A 2A...H1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load voltage L3	float	4	[V]
8	Mains voltage L1	integer	2	[V]
10	Mains voltage L3	integer	2	[V]
12	Switch-on time TS	integer	2	[period]
14	Total setpoint	integer	2	4096=100%
16	Fault (see table 14b)	integer	2	-
18	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 10 Cyclic input and output data with Thyro-A 2A...HRL1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load voltage L3	float	4	[V]
8	Load current L1	float	4	[A]
12	Load current L2	float	4	[A]
16	Load current L3	float	4	[A]
20	Mains voltage L1	integer	2	[V]
22	Mains voltage L3	integer	2	[V]
24	Switch-on time TS	integer	2	[period]
26	Total setpoint	integer	2	4096=100%
28	Fault (see table 14b)	integer	2	-
30	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 11 Cyclic input and output data with Thyro-A 2A...HRLP1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load voltage L3	float	4	[V]
8	Load current L1	float	4	[A]
12	Load current L2	float	4	[A]
16	Load current L3	float	4	[A]
20	Power L1	float	4	[W]
24	Power L3	float	4	[W]
28	Total power	float	4	[W]
32	Mains voltage L1	integer	2	[V]
34	Mains voltage L3	integer	2	[V]
36	Switch-on time TS	integer	2	[period]
38	Total setpoint	integer	2	4096=100%
40	Fault (see table 14b)	integer	2	-
42	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 12 Cyclic input and output data with Thyro-A 3A...H1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load voltage L2	float	4	[V]
8	Load voltage L3	float	4	[V]
12	Mains voltage L1	integer	2	[V]
14	Mains voltage L2	integer	2	[V]
16	Mains voltage L3	integer	2	[V]
18	Switch-on time TS	integer	2	[period]
20	Switch-on angle alpha	integer	2	[0.01 °el]
22	Total setpoint	integer	2	4096=100%
24	Fault (see table 14b)	integer	2	-
26	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 13 Cyclic input and output data with Thryo-A 3A...HRL1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load voltage L2	float	4	[V]
8	Load voltage L3	float	4	[V]
12	Load current L1	float	4	[A]
16	Load current L2	float	4	[A]
20	Load current L3	float	4	[A]
24	Mains voltage L1	integer	2	[V]
26	Mains voltage L2	integer	2	[V]
28	Mains voltage L3	integer	2	[V]
30	Switch-on time TS	integer	2	[period]
32	Switch-on angle alpha	integer	2	[0.01 °el]
34	Total setpoint	integer	2	4096=100%
36	Fault (see table 14b)	integer	2	-
38	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 14 Cyclic input and output data with Thryo-A 3A...HRLP1**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load voltage L2	float	4	[V]
8	Load voltage L3	float	4	[V]
12	Load current L1	float	4	[A]
16	Load current L2	float	4	[A]
20	Load current L3	float	4	[A]
24	Power L1	float	4	[W]
28	Power L2	float	4	[W]
32	Power L3	float	4	[W]
36	Total power	float	4	[W]
40	Mains voltage L1	integer	2	[V]
42	Mains voltage L2	integer	2	[V]
44	Mains voltage L3	integer	2	[V]
46	Switch-on time TS	integer	2	[period]
48	Switch-on angle alpha	integer	2	[0.01 °el]
50	Total setpoint	integer	2	4096=100%
52	Fault (see table 14b)	integer	2	-
54	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 14a Thyro-A Fault**

Description	Bit	LEDs	Relay
Frequency measurement outside of 47Hz to 63Hz	Bit 0	Pulse Inhibit LED flashing slowly	open
SYNC error, no cero crossing within the gate	Bit 1	Pulse Inhibit LED flashing slowly	open
Temperature monitoring triggered	Bit 2	Load Fault LED flashing slowly	open
Load fault	Bit 3	Load fault LED on	open
Flash values invalid	Bit 4	Pulse Inhibit LED and Load Fault LED flashing simultaneously quickly	open
Mains undervoltage (<AD_P_SPG_MIN)	Bit 5	Pulse Inhibit LED, Load Fault LED and test LED on	open
Mains overvoltage (>AD_P_SPG_MAX)	Bit 6	none	open
Master / slave fault (only with 2A)	Bit 8	none	closed
Undervoltage limit	Bit 9	none	closed
Overvoltage limit	Bit 10	none	closed
Undercurrent limit	Bit 11	none	closed
Overcurrent limit	Bit 12	none	closed
Low power limit	Bit 13	none	closed
High power limit	Bit 14	none	closed

**Tab. 14b Thyro-A Status**

Description	Bit	LEDs	Relay
Pulse inhib active (bridge X2.1-X2.2 open)	Bit 0	Pulse Inhibit LED on	closed
Mains frequency is 60Hz	Bit 2	none	closed
U-limiting	Bit 4	Pulse Inhibit LED and Load Fault LED flashing alternately slowly	closed
I-limiting	Bit 5	Pulse Inhibit LED and Load Fault LED flashing alternately slowly	closed
P-limiting	Bit 6	Pulse Inhibit LED and Load Fault LED flashing alternately slowly	closed
Relay status (0=relay off / 1=relay on)	Bit 8	none	on/off
Device switched off	Bit 9	--	--
Wrong device	Bit 10	--	--
Bus module active (0=no bus module / 1=bus module active)	Bit 11	only with Thyro-S	----
Thyristor short-circuit	Bit 14	only with Thyro-S	----
Failure rotating field / phase (only Thyro 2A or 3A)	Bit 15	Pulse Inhibit LED and Test LED flashing simultaneously slowly	closed
Overcurrent limit	Bit 12	none	closed
Low power limit	Bit 13	none	closed
High power limit	Bit 14	none	closed

**Tab. 15 Cyclic input and output data with Thryo-A 1A...C01**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load current L1	float	4	[A]
8	Power L1	float	4	[W]
12	Mains voltage L1	integer	2	[V]
14	Switch-on time TS	integer	2	[period]
16	Switch-on angle alpha	integer	2	[0.01 °el]
18	Total setpoint	integer	2	4096=100%
20	Fault (see table 14b)	integer	2	-
22	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 16 Cyclic input and output data with Thryo-A 1A...C02**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage phase 1	float	4	[V]
4	Load current phase 1	float	4	[A]
8	Load current phase 2	float	4	[A]
12	Total load current	float	4	[A]
16	Mains voltage L1	integer	2	[V]
18	Switch-on angle alpha phase 1	integer	2	[0.01 °el]
20	Total setpoint	integer	2	4096=100%
22	Fault (see table 14b)	integer	2	-
24	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 17 Cyclic input and output data with Thryo-A 1A...C03**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load current L1	float	4	[A]
8	Power L1	float	4	[W]
12	Mains voltage L1	integer	2	[V]
14	Switch-on time TS	integer	2	[period]
16	Switch-on angle alpha	integer	2	[0.01 °el]
18	Total setpoint	integer	2	4096=100%
20	Fault (see table 14b)	integer	2	-
22	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint values	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 18 Cyclic input and output data with Thyro-A 1A...C05**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage phase 1	float	4	[V]
4	Load current phase 1	float	4	[A]
8	Load current phase 2	float	4	[A]
12	Total load current	float	4	[A]
16	Power phase 1	float	4	[W]
20	Power phase 2	float	4	[W]
24	Total power	float	4	[W]
28	Mains voltage L1	integer	2	[V]
30	Switch-on angle alpha phase 1	integer	2	[0.01 °el]
32	Total setpoint	integer	2	4096=100%
34	Fault (see table 14b)	integer	2	-
36	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

**Tab. 19 Cyclic input and output data with Thyro-A 1A...C07**

Offset	Input data, actual values	Data type	Size	Unit
0	Load voltage L1	float	4	[V]
4	Load current L1	float	4	[A]
8	Power L1	float	4	[W]
12	Mains voltage L1	integer	2	[V]
14	Load temperature	integer	2	[°C]
16	Switch-on angle alpha	integer	2	[0.01 °el]
18	Total setpoint	integer	2	4096=100%
20	Fault (see table 14b)	integer	2	-
22	Status (see table 14b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

#### Supported operating modes TPM; TSC; TMU

With the Thyro-Power Manager, Thyro-Step Controller and Thyro-Measurement Unit the input and output data are depend on the operating mode. The following table shows which operating mode the devices support.

**Tab. 20 Supported operating modes**

	TPM		TSC	TIO	TMU
	automatic	manual			
Thyro-Power Manager	X	X	X	X	X
Thyro-Step Controller	-	-	X	X	X
Thyro-Measurement Unit	-	-	-	X	X

## 6.5 Input and output data Thyo-Power Manager

**Tab. 21 Cyclic input and output data TPM automatic mode**

Offset	Input data, actual values	Data type	Size	Unit
0	AC input 1	float	4	[A],[V]
4	AC input 2	float	4	[A],[V]
8	AC input 3	float	4	[A],[V]
12	Power	float	4	[W]
16	Energy	float	4	[kWh]
20	DC input 1	integer	2	4096=100%
22	DC input 2	integer	2	4096=100%
24	DC input 3	integer	2	4096=100%
26	Mains voltage	integer	2	[V]
28	Period duration	integer	2	[μs]
30	Temperature	integer	2	[°C]
32	Fault (see table 25b)	integer	2	-
34	Status (see table 25b)	integer	2	-

**Tab. 22 Cyclic input and output data TPM manual mode**

Offset	Input data, actual values	Data type	Size	Unit
0	AC input 1	float	4	[A],[V]
4	AC input 2	float	4	[A],[V]
8	AC input 3	float	4	[A],[V]
12	Power	float	4	[W]
16	Energy	float	4	[kWh]
20	DC input 1	integer	2	4096=100%
22	DC input 2	integer	2	4096=100%
24	DC input 3	integer	2	4096=100%
26	Mains voltage	integer	2	[V]
28	Period duration	integer	2	[μs]
30	Temperature	integer	2	[°C]
32	Fault (see table 25b)	integer	2	-
34	Status (see table 25b)	integer	2	-

## 6.6 Input and output data Thyro-Step Controller

Tab. 23 Cyclic input and output data TSC mode

Offset	Input data, actual values	Data type	Size	Unit
0	AC input 1	float	4	[A],[V]
4	AC input 2	float	4	[A],[V]
8	AC input 3	float	4	[A],[V]
12	Power	float	4	[W]
16	Energy	float	4	[kWh]
20	DC input 1	integer	2	4096=100%
22	DC input 2	integer	2	4096=100%
24	DC input 3	integer	2	4096=100%
26	Mains voltage	integer	2	[V]
28	Period duration	integer	2	[μs]
30	Temperature	integer	2	[°C]
32	Fault (see table 25b)	integer	2	-
34	Status (see table 25b)	integer	2	-
36	Analog output 4	integer	2	4096=100%
38	Steps	integer	2	-
40	Total setpoint	Integer	2	4096=100%
Offset	Output data, setpoint	Data type	Size	Unit
0	Master setpoint	integer	2	4096=100%

## 6.7 Input and output data Thyro Input/Output Unit

Tab. 24 Cyclic input and output data TIO mode

Offset	Input data, actual values	Data type	Size	Unit
0	AC input 1	float	4	[A],[V]
4	AC input 2	float	4	[A],[V]
8	AC input 3	float	4	[A],[V]
12	Power	float	4	[W]
16	Energy	float	4	[kWh]
20	DC input 1	integer	2	4096=100%
22	DC input 2	integer	2	4096=100%
24	DC input 3	integer	2	4096=100%
26	Mains voltage	integer	2	[V]
28	Period duration	integer	2	[μs]
30	Temperature	integer	2	[°C]
32	Fault (see table 25b)	integer	2	-
34	Status (see table 25b)	integer	2	-
Offset	Output data, setpoint	Data type	Size	Unit
0	Digital output	integer	2	-
2	Analog output 1	integer	2	4096=100%
4	Analog output 2	integer	2	4096=100%
6	Analog output 3	integer	2	4096=100%
8	Analog output 4	integer	2	4096=100%
10	Analog output 5	integer	2	4096=100%
12	Analog output 6	integer	2	4096=100%

## 6.8 Input and output data Thyo-Measurement Unit

Tab. 25 Cyclic input and output data TMU mode

Offset	Input data, actual values	Data type	Size	Unit
0	AC input 1	float	4	[A],[V]
4	AC input 2	float	4	[A],[V]
8	AC input 3	float	4	[A],[V]
12	Power	float	4	[W]
16	Energy	float	4	[kWh]
20	DC input 1	integer	2	4096=100%
22	DC input 2	integer	2	4096=100%
24	DC input 3	integer	2	4096=100%
26	Mains voltage	integer	2	[V]
28	Period duration	integer	2	[μs]
30	Temperature	integer	2	[°C]
32	Fault (see table 25b)	integer	2	-
34	Status (see table 25b)	integer	2	-

Tab. 25b Status TPM, TSC, TIO, TMU

Description	Bit	Fault LED, fault output*
Frequency measurement outside of 47Hz to 63Hz	Bit 0	on
SYNC error, no zero crossing within the gate	Bit 1	on
Temperature max. limit has been exceeded	Bit 2	on
Temperature min. limit has been exceeded	Bit 3	on
One or more parameters outside the limits	Bit 4	on
Mains voltage lower than lower voltage limit	Bit 5	on

Tab. 25b Fault TPM, TSC, TIO, TMU

Description	Bit	Alarm LED, alarm output*
Mains frequency is 60Hz	Bit 2	off
Transformer 1 fallen below min. limit	Bit 3	on
Transformer 1 exceeded max. limit	Bit 4	on
Transformer 2 fallen below min. limit	Bit 5	on
Transformer 2 exceeded max. limit	Bit 6	on
Transformer 3 fallen below min. limit	Bit 7	on
Transformer 3 exceeded max. limit	Bit 8	on
Device switched off	Bit 9	--
Wrong device	Bit 10	--
Bus module active (0=no bus module / 1=bus module active)	Bit 11	off

\* Default setting can be parameterized.

## 6.9 Acyclic data transmission (parameterization)

Via the acyclic parameter data transmission, parameters of the devices can be changed or selected. Cyclical and acyclical services can be used in the network simultaneously.

### Read data record “RDREC”:

For reading access to a data record, the slot, index and length of the data record must be entered. At step 7 and when using the SFB 52 the Logical Address of the slot is to be entered instead of the slot. As such the device at slot X1 is to be activated as the device at slot 1.

Error code	Meaning
DE80B000	The unit does not recognize the parameter (invalid index)
DE80B100	The length entry of the parameter is incorrect
DE80B200	The projected slot is not occupied
DE80B300	The actual unit type does not match the set unit type

### Write data record “WRREC”:

For writing access to a data record, the slot, index, length of the data record and the new value must be entered. At step 7 and when using the SFB 53 the Logical Address of the slot is to be entered instead of the slot.

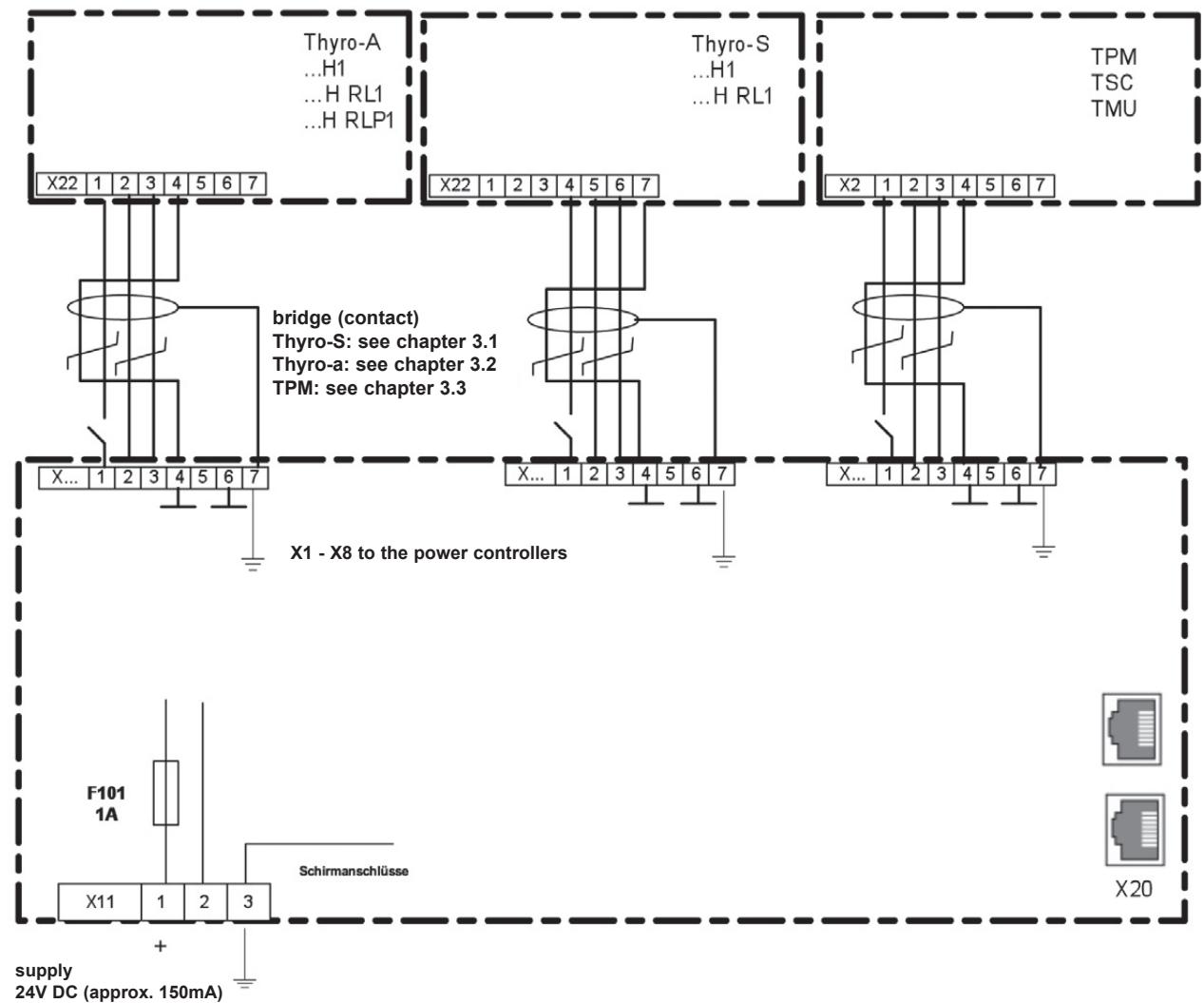
Error code	Meaning
DF80B000	The unit does not recognize the parameter (invalid index)
DF80B100	The length entry of the parameter is incorrect
DF80B200	The projected slot is not occupied
DF80B300	The actual unit type does not match the set unit type
DF80B600	The parameter cannot be changed
DF80B700	Invalid range of values of a parameter

You will find the parameter tables (acyclic) of each of the device types in Appendix 17 (A).

## 7. External connections

### 7.1 Power supply

+24V to X11, current consumption approx. 150mA



The foregoing circuit diagram shows the connection of the bus module

## 7.2 Operating elements and terminal blocks

This chapter describes the available terminal blocks, plug connectors and operating elements.

Configuration of the 7 pin connector of slots X1 to X8:

- 1      Switched ground potential. All pins 1 of slots X1 – X8 are connected.
- 2      RxD
- 3      TxD
- 4      Ground
- 5      Switchable ground potential. The slots X1 – X8 can be switched as desired.
- 6      Ground
- 7      Ground potential for shield connection

Configuration of the 3 pin connector X11:

- X11:    +24V
- X11:    24V - ground
- X11:    Grounding, carry out by as short a route as possible.

## 8. Interfaces

### 8.1 System interface

The bus module is connected with the relevant system interfaces of the power controllers via X1 to X8 (four-wire, 2x2 twisted, shared shielding).

The transmission rate is 38,400 Bd.

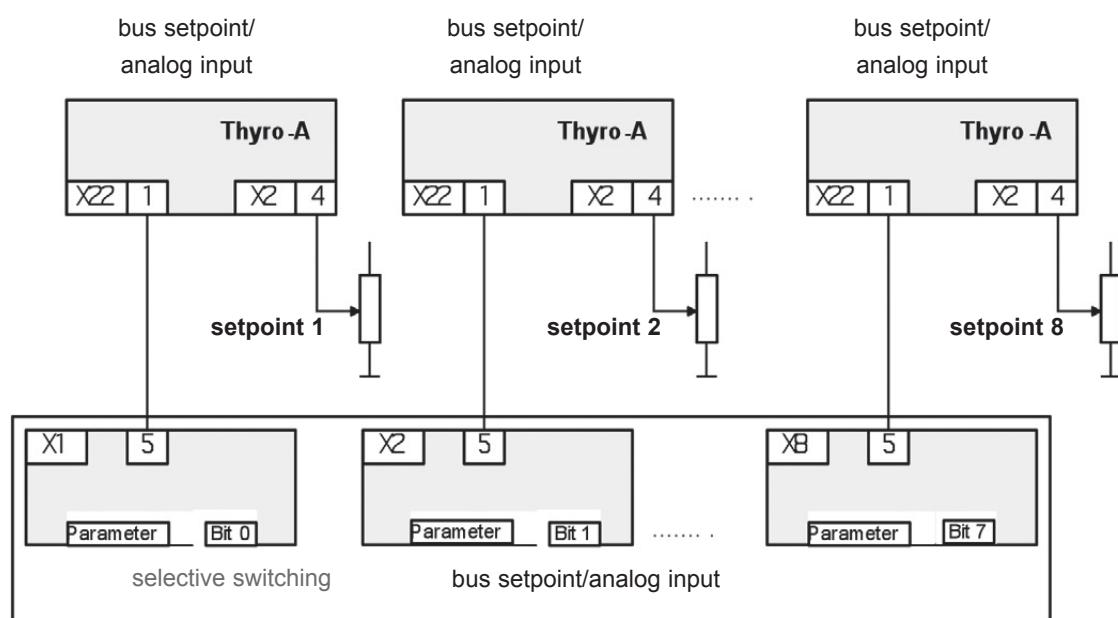
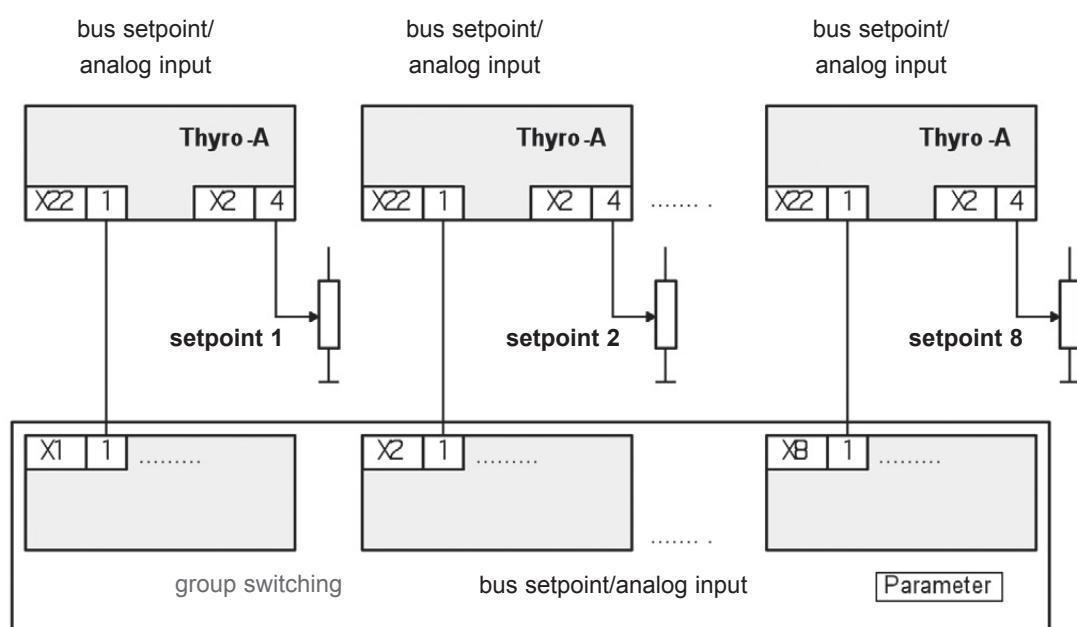
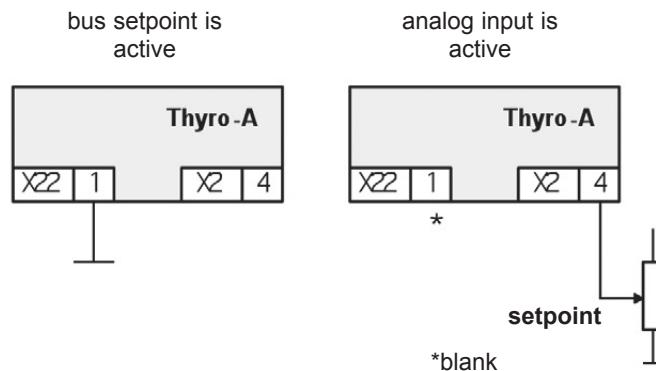
The asynchronous characters are transferred with 8bit, no parity, one stop bit. The protocol begins with STX, followed by an identifier, the data, and is concluded with a check sum. Defective protocols are ignored.

### 8.2 Ethernet interfaces

Communication medium	CAT 5e
Network topology	tree, star and line
Maximum cable length	100m
ProfiNET-participants	restricted to the maximum supported number of devices by the controller used
PNO identification number	0x0188
Device ID	0x0001
Transmission rate	100 Mbit/s

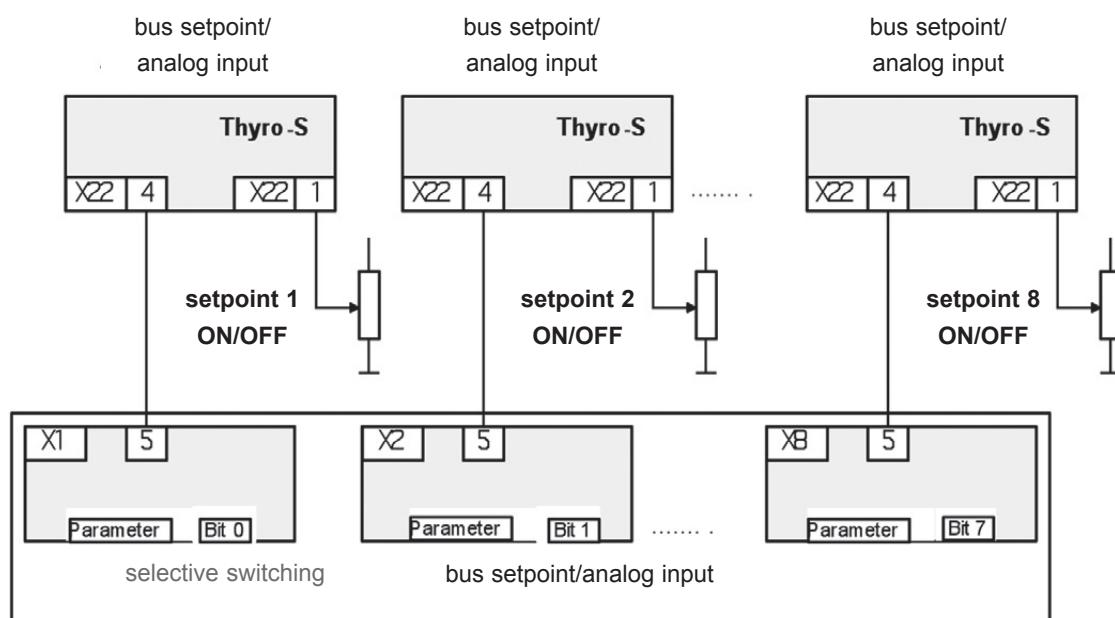
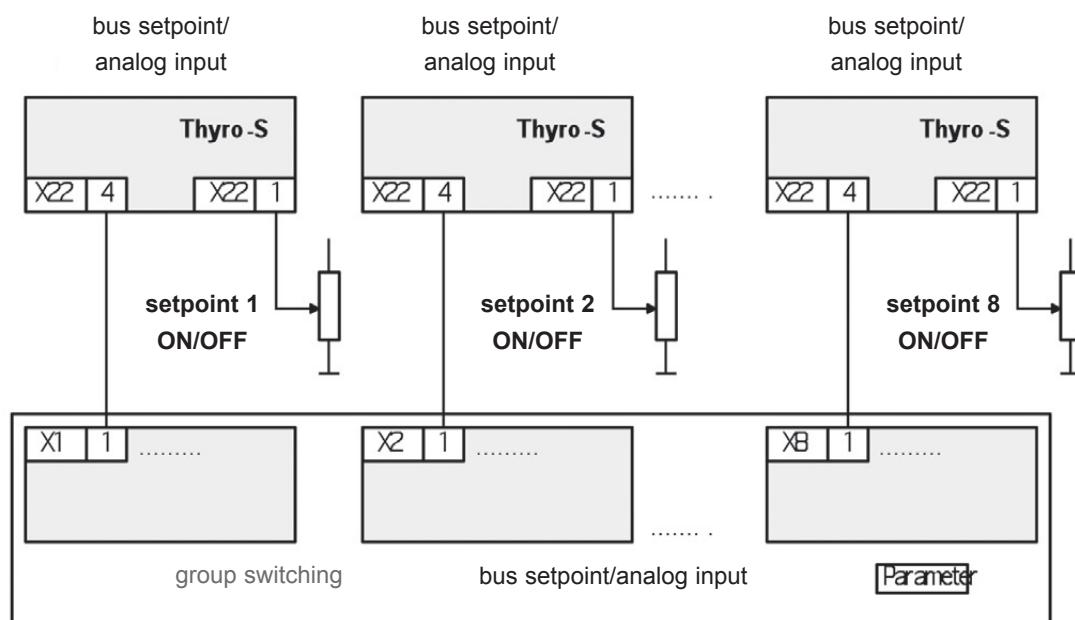
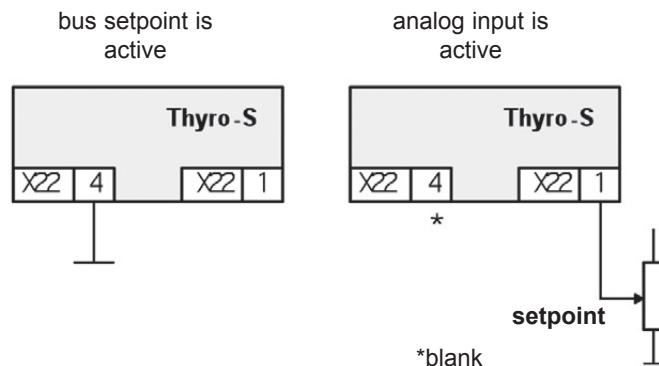
## 9. Connection diagrams Thyro-A

Fig. 2 Connection diagram Thyro-A



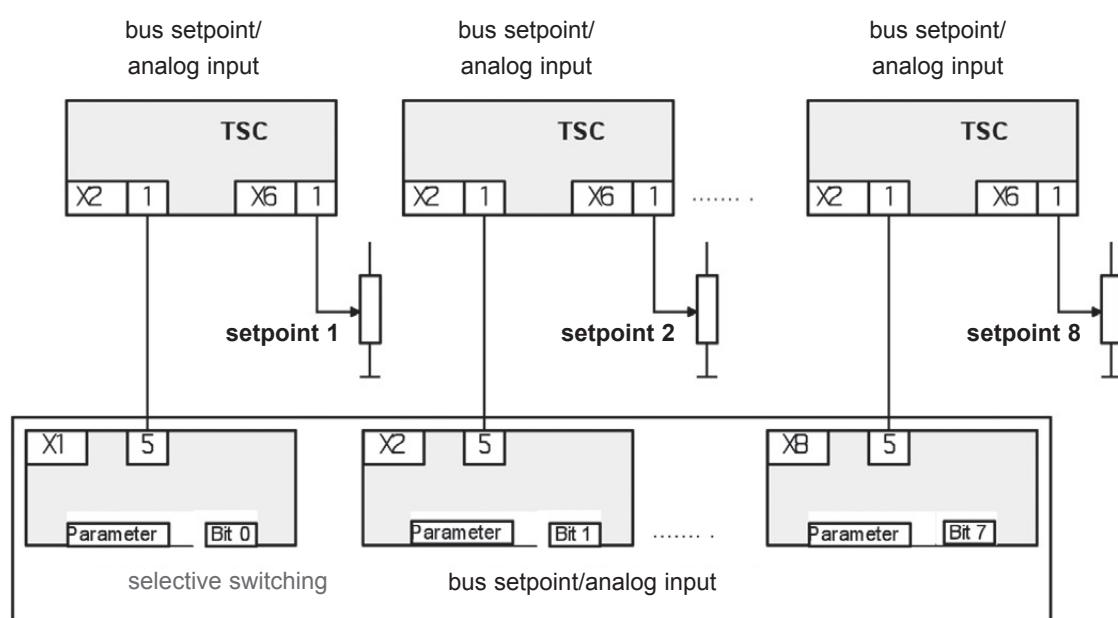
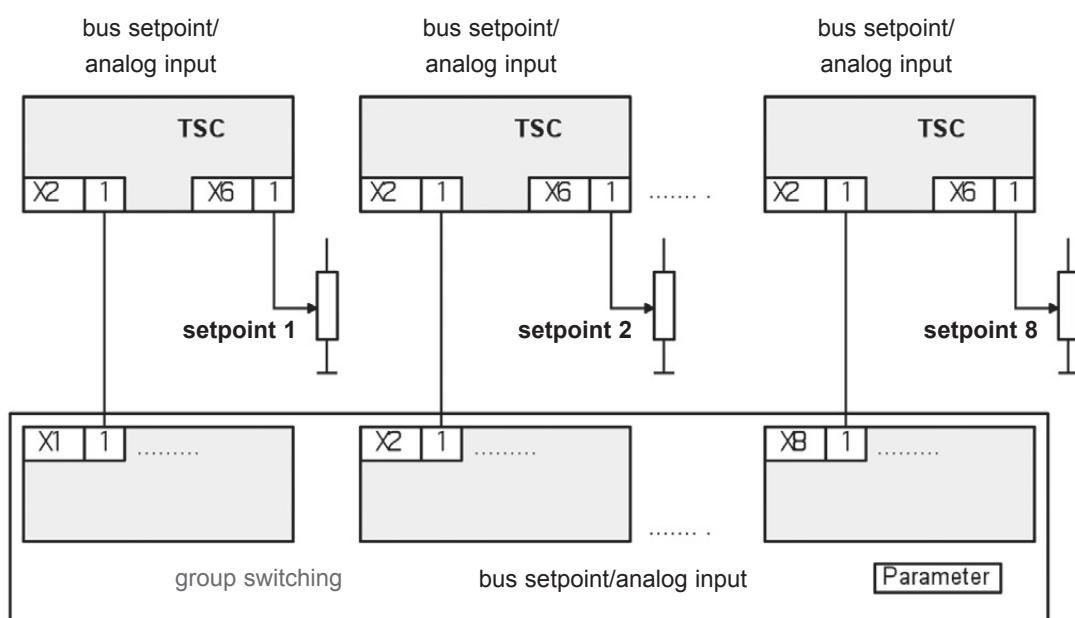
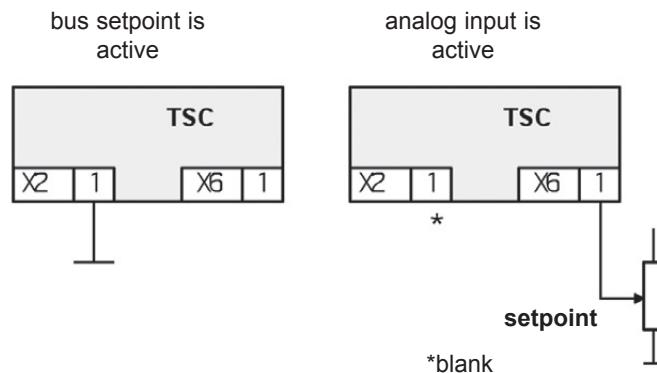
## 10. Connection diagrams Thyro-S

**Fig. 3 Connection diagram Thyro-S**



# 11. Connection diagrams TSC

Fig. 4 Connection diagram TSC



## 12. Specific notes

### 12.1 Installation

The bus modules can be installed in any desired order.

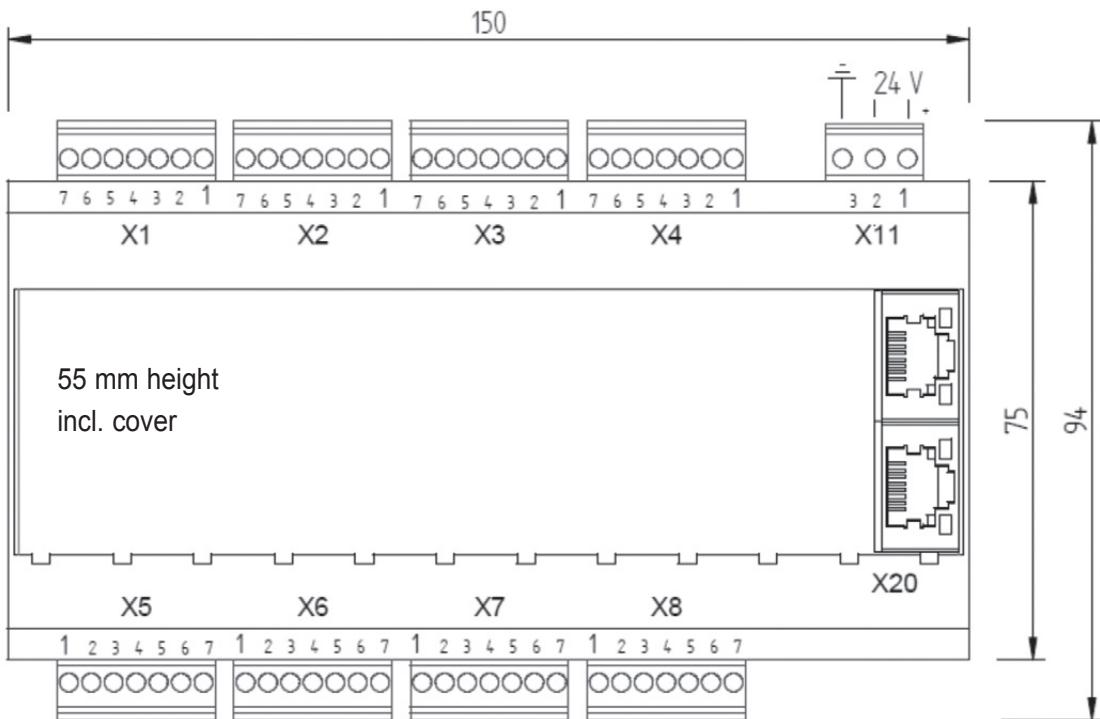
### 12.2 Service

The devices supplied have been produced in accordance with the quality standard ISO 9001. Should there be faults in spite of this, our 24 hour service hotline is on hand, tel.: +49 (0)2902 763-100.

## 13. Technical Data

Power supply	24V DC 150mA
Connection options for	up to 8 AEG power controllers of series Thyro-S, Thyro-A and the TPM series
Function control	LED
Assembly	DIN rail
Ambient temperature	maximum 55°C
Dimensions (WxDxH):	150 x 60 x 95 mm
Weight circa:	0.35 kg

## 14. Dimension drawings



## 15. Accessories and options

Ready-made bus module-side shielded cable.

A set of cable consists of 4 connection cables for connecting 4 power controllers.

Order number 2000 000 848 Bus module connection cable for 4 controllers, 2.5 m long

Order number 2000 000 849 Bus module connection cable for 4 controllers, 1.5 m long

## 16. Approvals and conformity

- Quality standard in acc. with EN ISO 9001
- CE conformity
- Profinet conformity
- RoHS compliant 5/6

- Directives

The CE mark on the device confirms compliance with the EC directives 2006 / 95 / EEC for low voltage and 2004 / 108 / EEC for electromagnetic compatibility if the instructions on installation and commissioning described in the operating instructions are followed.

## In detail

ProfiNet		IEC 61158 IEC 61784
Built-in device (VDE0160)		EN 50 178
Storage temperature (D)		-25°C - +55°C
Transport temperature		-25°C - +70°C
Operating temperature (better B)		-10°C - +55°C
Humidity class	B	EN 50 178 tab. 7 (EN 60 721)
Degree of contamination	2	EN 50 178 tab. 2
Air pressure		900mbar * 1000m above sea level
Degree of protection	IP00	EN 69 529
EMC-testing		EN 61000-6-2 (-4)
Emitted interference		CISPR 16
Radiated immunity		EN/IEC 61000-4-3
Conducted immunity		EN/IEC 61000-4-6
ESD	8kV (A)	EN/IEC 61000-4-2
Burst control lines	1kV (A)	EN 61000-4-4

# 17. Appendix A

## 1. Acyclic parameter table Thryo-S; Thryo-A; -C01; -C02; -C03; -C05

Table A: Thryo-S., Thryo-A., Thryo-A-C01; -C02; -C03; -C05 controller parameters slot 1-8

Controller parameter		Name	Data type	Value range	Combo-opt.
Index	Symbol				
1	I_TYP	Controller type current	u16	0...	
2	U_TYP	Controller supply voltage	u16	0...1000	
3	P_TYP	Controller type output power	u32	0...	
6	BETR	Operating mode	u16	0...3	Reserved, TAKT, VAR, QTM
7	AN1	Phase angle of 1st half wave	u16	0...180	
8		Soft start duration (given)			
9	SDN	Soft stop duration (given)	u16	0...1000	
10	T0	Cycle period duration	u16	0...1000	
11	MP	Minimum interval	u16	0...10	
12	TSMAX	Maximum cycle turn on time	u16	1...T0	
13	TSMIN	Minimum cycle turn on time	u16	0...T0	
14	V_IE	Front pulse stop	u16	0...180	
15	H_IE	Back pulse stop	u16	0...180	
16	RE	Control (analog output value)	u16	0...8	U <sub>load</sub> 2, U <sub>load eff</sub> , I <sub>load</sub> 2, I <sub>load eff</sub> reserved, real power, reserved, reserved, without regulation
17	TI_1	PI controller, I part	u16	0= aus 0...65535	
18	KP_1	PI controller, P part	u16	0= aus 0...65535	
19	KR_1	PI controller, counter P part	u16	0...65535	
20	V_IE_2	Front pulse stop phase 2	u16	0...180	
21	UEMA	Effective voltage setpoint maximum	u16	0...	
22	IEMA	Effective current setpoint maximum	u16	0...	
23	PMA	Power setpoint maximum	u32	0...	
24	SW_ENABLE	Setpoint activation	u16	0...3	Bit0=1 setpoint x2.4 active, Bit1=1 setpoint master active
27	SW_REGLER	Setpoint x2.4	u16	0...4096	
28	OF_1	Actual value output offset 1	u16	0...4096	
29	FA_1	Scale end value actual value output 1	u16	0...4096	
30	SPG_MIN	Mains voltage monitoring min.	u16	0...1000	
31	SPG_MAX	Mains voltage monitoring max.	u16	0...1000	
32	UN_S	Undercurrent monitoring	u16	0...1	on, off
33	RELAIS_CTRL_2	Relay configuration 2	u16	0...65535	bit coded
34	LASTBRUCH_MIN_ABS	Load fault, minimum value	u16	0...4505	
36	SYNC_ADR	Synchro cycle address	u16	0...65535	
37	IMAB	Pulse switch-off in case of failure	u16	0...65535	bit coded
38	STA_RE	Control start controller analog setpoint	u16	0...65535	
39	STE_RE	Control end controller analog setpoint	u16	0...65535	
40		Configuration 3A	u16		bit coded
41	MOSI_FA	Peak current value limit	u16	0...4096	
42	DAC_1_CTRL	Analog output configuration 1	u16	0...10	
44	VERS_T	Version day	u16	1...31	
45	VERS_M	Version month	u16	1...12	
46	VERS_J	Version year	u16	0...9999	
48		Controller inhibit	u16	0...1	on, off
49	RELAIS_CTRL	Relay configuration 1	u16	0...65535	bit coded
50		Save	u16	0...1	off, save
56	MITTEL	Averaging analog output 1	u16	0...65535	
84	TEMP	Temperature	u16	-50...150	
109	MITTEL_2	Averaging analog output 2	u16	0...65535	
110	OF_2	Actual value output offset 2	u16	0...4096	
111	FA_2	Scale end value actual value output 2	u16	0...4096	
112	DAC_2_CTRL	Analog output configuration 2	u16	0...10	
115	MITTEL_3	Averaging analog output 3	u16	0...65535	
116	OF_3	Actual value output offset 3	u16	0...4096	
117	FA_3	Scale end value actual value output 3	u16	0...4096	
118	DAC_3_CTRL	Analog output configuration 3	u16	0...10	
119	U_MIN	Voltage limit minimum	u16	0...65535	
120	U_MAX	Voltage limit maximum	u16	0...65535	
121	I_MIN	Current limit minimum	u16	0...65535	
122	I_MAX	Current limit maximum	u16	0...65535	
123	P_MIN	Power limit minimum	u32	0...	
124	P_MAX	Power limit maximum	u32	0...	

Unit	R / W	1S		1A		2A		3A		1A			Default	Note	Index			
		H1	HRL1	C01	C02	C03	C05											
A	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x	type		1
V	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x	type		2
W	r				x			x		x	x	x	x	x	x	H RLP1		3
r/w *		x	x	x	x	x	x	x	x	x	x	x	x	x	x	TAKT	S1.1-2	6
°el	r/w *		x	x	x	x	x	x	x	x	x	x	x	x	x	60°el	R201	7
period	r/w		x	x	x	x	x	x	x	x	x	x	x	x	x	6 period		9
period	r/w*		x	x	x	x	x	x	x	x	x	x	x	x	x	50 period	R201	10
period	r/w *		x	x	x	x	x	x	x	x	x	x	x	x	x	3 period	R201	11
period	r/w		x	x	x	x	x	x	x	x	x	x	x	x	x	50 period		12
period	r/w		x	x	x	x	x	x	x	x	x	x	x	x	x	0 period		13
°el	r/w		x	x	x			x	x	x	x	x	x	x	x	180°el		14
°el	r/w		x	x	x			x	x	x	x	x	x	x	x	0°el		15
	r/w *		x	x	x	x	x	x	x	x	x	x	x	x	x	Uload <sup>2</sup>	S1.3-5 power only with H RLP1	16
	r/w		x	x	x	x	x	x	x	x	x	x	x	x	x	20		17
	r/w		x	x	x	x	x	x	x	x	x	x	x	x	x	60		18
	r/w		x	x	x	x	x	x	x	x	x	x	x	x	x	10		19
period	r/w										x	x						20
0.1 V	r/w *		x	x	x	x	x	x	x	x	x	x	x	x	x	440V	R 202 **	21
0.1 A	r/w *		x	x	x	x	x	x	x	x	x	x	x	x	x	110A	R 203	22
W	r/w *			x		x		x		x	x	x	x	x	x	0	R 202 **	23
	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0		24
4096=100%	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x			27
20/4096mA	r/w *		x	x	x	x	x	x	x	x	x	x	x	x	x	0mA	S1.9	28
1/819	r/w *		x	x	x	x	x	x	x	x	x	x	x	x	x	1	R 204	29
V	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	type		30
V	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	type		31
	r/w *	x	x	x	x	x	x	x	x	x	x	x	x	x	x	off	R 205	32
	r/w		x	x	x	x	x	x	x	x	x	x	x	x	x	0		33
100/4096%	r/w *	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0%	R 205	34
period /2	r/w		x	x	x	x	x	x	x	x	x	x	x	x	x	100		36
	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0		37
20/4096mA	r/w *	x	x	x	x	x	x	x	x	x	x	x	x	x	x	0mA	S1.6	38
20/4096mA	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	20mA		39
	r/w								x	x	x							40
	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	type		41
	r/w		x	x	x	x	x	x	x	x	x	x	x	x	x	6		42
	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x			44
	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x			45
	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x			46
	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	off		48
	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	447		49
	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	off		50
	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x	100		56
°C	r	x	x	x	x	x	x	x	x	x	x	x	x	x	x			84
	r/w									x	x					100		109
20/4096mA	r/w									x	x	x	x	x	x	0mA	S1.9	110
1/819	r/w									x	x	x	x	x	x	1	R 204	111
	r/w									x	x	x	x	x	x	6		112
	r/w									x	x	x	x	x	x	100		115
20/4096mA	r/w									x	x	x	x	x	x	0mA	S1.9	116
1/819	r/w									x	x	x	x	x	x	1	R 204	117
	r/w									x	x	x	x	x	x	6		118
0.1 V	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x			119
0.1 V	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x			120
0.1 A	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x			121
0.1 A	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x			122
W	r/w	x	x	x	x	x	x	x	x	x	x	x	x	x	x			123
W	r/w		x		x		x		x		x	x	x	x	x			124

## 2. Acyclic parameter table Thyro-C07

Table B: Thyro-C07 controller parameters slot 1-8

Controller parameter					
Index	Symbol	Name	Data type	Value range	Combo-opt.
1	L_TYP	Controller type current	u16	0...	
2	U_TYP	Controller supply voltage	u16	0...1000	
3	P_TYP	Controller type output power	u32	0...	
6	BETR	Operating mode	u16	0...3	reserved, TAKT, VAR, QTM
7	AN1	Phase angle of 1st half wave	u16	0...180	
9	SDN	Soft stop duration (given)	u16	0...1000	
10	T0	Cycle period duration	u16	0...1000	
11	MP	Minimum interval	u16	0...10	
12	TSMAX	Maximum cycle turn on time	u16	1...T0	
13	TSMIN	Minimum cycle turn on time	u16	0...T0	
14	V_IE	Front pulse stop	u16	0...180	
15	H_IE	Back pulse stop	u16	0...180	
16	RE	Control (analog output value)	u16	0...9	Uload2, Uload eff, Iload2, Iload eff, reserved, real power, reserved, reserved, without regulation, temperature
17	TI_1	PI controller, I part	u16	0= aus 0...65535	
18	KP_1	PI controller, P part	u16	0= aus 0...65535	
19	KR_1	PI controller, counter P part	u16	0...65535	
20		Temperature coefficient of the heating tape	u16	0...65535	
21	UEMA	Effective voltage setpoint maximum	u16	0...	
22	IEMA	Effective current setpoint maximum	u16	0...	
23	PMA	Power setpoint maximum	u32	0...	
24	SW_ENABLE	Setpoint activation	u16	0...3	bit0=1 setpoint x2.4 active, bit1=1 setpoint master active
27	SW_REGLER	Setpoint x2.4	u16	0...4096	
28	OF_1	Actual value output offset 1	u16	0...4096	
29	FA_1	Scale end value actual value output 1	u16	0...4096	
30	SPG_MIN	Mains voltage monitoring min.	u16	0...1000	
31	SPG_MAX	Mains voltage monitoring max.	u16	0...1000	
32	UN_S	Undercurrent monitoring	u16	0...1	off, on
33	RELAIS_CTRL_2	Relay configuration 2	u16	0...65535	bit coded
34	LASTBRUCH_MIN_ABS	Load fault, minimum value	u16	0...4505	
36	SYNC_ADR	Synchro cycle address	u16	0...65535	
37	IMAB	Pulse switch-off in case of failure	u16	0...65535	bit coded
38	STA_RE	Control start controller analog setpoint	u16	0...65535	
39	STE_RE	Control end controller analog setpoint	u16	0...65535	
41	MOSI_FA	Peak current value limit	u16	0...4096	
42	DAC_1_CTRL	Analog output configuration 1	u16	0...11	
44	VERS_T	Version day	u16	1...31	
45	VERS_M	Version month	u16	1...12	
46	VERS_J	Version year	u16	0...9999	
48		Controller inhibit	u16	0...1	off, on
49	RELAIS_CTRL	Relay configuration 1	u16	0...65535	bit coded
50		Save	u16	0...1	off, save
56	MITTEL	Averaging analog output 1	u16	0...65535	
84	TEMP	Temperature	u16	-50...150	
109	MITTEL_2	Averaging analog output 2	u16	0...65535	
110	OF_2	Actual value output offset 2	u16	0...4096	
111	FA_2	Scale end value actual value output 2	u16	0...4096	
112	DAC_2_CTRL	Analog output configuration 2	u16	0...11	
115	MITTEL_3	Averaging analog output 3	u16	0...65535	
116	OF_3	Actual value output offset 3	u16	0...4096	
117	FA_3	Scale end value actual value output 3	u16	0...4096	
118	DAC_3_CTRL	Analog output configuration 3	u16	0...11	
119	U_MIN	Voltage limit minimum	u16	0...65535	
120	U_MAX	Voltage limit maximum	u16	0...65535	
121	I_MIN	Current limit minimum	u16	0...65535	
122	I_MAX	Current limit maximum	u16	0...65535	
123	P_MIN	Power limit minimum	u32	0...	
124	P_MAX	Power limit maximum	u32	0...	

unit	R / W	Default	Note	Index
A	r	type		1
V	r	type		2
W	r	type	H RLP1	3
	r/w *	TAKT	S1.1-2	6
°el	r/w *	60°el	R201	7
period	r/w	6 period		9
period	r/w*	50 period	R201	10
period	r/w *	3 period	R201	11
period	r/w	50 period		12
period	r/w	0 period		13
°el	r/w	180°el		14
°el	r/w	0°el		15
	r/w *	Upload2	S1.3-5 power only with H RLP1	16
	r/w	20		17
	r/w	60		18
	r/w	10		19
	r/w			20
0.1V	r/w *	440V	R202**	21
0.1A	r/w *	110A	R203	22
W	r/w *	0	R202**	23
	r	0		24
4096=100%	r			27
20/4096mA	r/w *	0mA	S1.9	28
1/819	r/w *	1	R204	29
V	r/w	type		30
V	r/w	type		31
	r/w *	off	R205	32
	r/w	0		33
100/4096%	r/w *	0%	R205	34
period/2	r/w	100		36
	r/w	0		37
20/4096mA	r/w *	0mA	S1.6	38
20/4096mA	r/w	20mA		39
	r/w	type		41
	r/w	6		42
	r			44
	r			45
	r			46
	r/w	off		48
	r/w	447		49
	r/w	off		50
	r/w	100		56
°C	r			84
	r/w	100		109
20/4096mA	r/w	0mA	S1.9	110
1/819	r/w	1	R204	111
	r/w	6		112
	r/w	100		115
20/4096mA	r/w	0mA	S1.9	116
1/819	r/w	1	R204	117
	r/w	6		118
0.1V	r/w			119
0.1V	r/w			120
0.1A	r/w			121
0.1A	r/w			122
W	r/w			123
W	r/w			124

### 3. Acyclic parameter table Thyo-Power Manager

Table C: TPM parameters slot 1-8

Controller parameter					
Index	Symbol	Name	Data type	Value range	Combo-opt.
1	W1_TYP	Type value transformer 1	u16	1...65535	
2	W2_TYP	Type value transformer 2	u16	1...65535	
3	W3_TYP	Type value transformer 3	u16	1...65535	
4	W_CTRL	Transformer setting	u16	0...65535	bit coded
5	U_TYP	Type value U mains	u16	1...260	
8	ANZ	Number	u16	2...10	
9	T01	1st time / phase 1	u16	0...T0	
10	T02	2nd time / phase 2	u16	0...T0	
11	T03	3rd time / phase 3	u16	0...T0	
12	T04	4th time / phase 4	u16	0...T0	
13	T05	5th time / phase 5	u16	0...T0	
14	T06	6th time / phase 6	u16	0...T0	
15	T07	7th time / phase 7	u16	0...T0	
16	T08	8th time / phase 8	u16	0...T0	
17	T09	9th time / phase 9	u16	0...T0	
18	T10	10th time / phase 10	u16	0...T0	
39	DAC1_OF	Offset 1	u16	0...4095	
40	DAC1_FA	Scale end value 1	u16	0...4096	
41	DAC1_CTRL	Output value 1	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
42	DAC2_OF	Offset 2	u16	0...4095	
43	DAC2_FA	Scale end value 2	u16	0...4096	
44	DAC2_CTRL	Output value 2	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
45	DAC3_OF	Offset 3	u16	0...4095	
46	DAC3_FA	Scale end value 3	u16	0...4096	
47	DAC3_CTRL	Output value 3	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
48	DAC4_OF	Offset 4	u16	0...4095	
49	DAC4_FA	Scale end value 4	u16	0...4096	
50	DAC4_CTRL	Output value 4	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
51	DAC5_OF	Offset 5	u16	0...4095	
52	DAC5_FA	Scale end value 5	u16	0...4096	
53	DAC5_CTRL	Output value 5	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
54	DAC6_OF	Offset 6	u16	0...4095	
55	DAC6_FA	Scale end value 6	u16	0...4096	
56	DAC6_CTRL	Output value 6	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
57	DAC_MITTEL	Average	u16	1...65535	
58	SPG_MIN	Lower limit mains voltage	u16	0...5120	
59	SPG_MAX	Upper limit mains voltage	u16	0...5120	
60	W1_MAX	Limit transformer 1	u16	0...8192	
61	W2_MAX	Limit transformer 2	u16	0...8192	
62	W3_MAX	Limit transformer 3	u16	0...8192	
63	WA_CTRL	Monitoring mode transformer	u16	0...65535	bit coded
64		Fault output	u16	0...65535	bit coded
66		Alarm output	u16	0...65535	bit coded
68	Vers_D	Firmware version day	u16	1...31	
69	Vers_M	Firmware version month	u16	1...12	
70	Vers_Y	Firmware version year	u16	0...9999	
72		Save	u16	0...1	off, save
74		Operating hours	f32	0...	
76	TEMP_MAX	Limiting value temperature	u16	0...255	
99		Energy	f32	0...	
105		Analog output 1	u16	0...4096	
106		Analog output 2	u16	0...4096	
107		Analog output 3	u16	0...4096	
108		Analog output 4	u16	0...4096	
109		Analog output 5	u16	0...4096	
110		Analog output 6	u16	0...4096	
121		Device number	u32	0...	
123		Serial number	u16	0...	
124		PCB number	u32	0...	
126	F_MIN_MAX	Frequency limit	u16	100...2500	
127	F_TOL	Frequency tolerance	u16	1...25	

Unit	R / W	Default	Note	Index
	r/w	100		1
	r/w	100		2
	r/w	100		3
	r/w	8		4
	r/w	230		5
	r/w *	10	S2	8
	r/w	0		9
	r/w	5		10
	r/w	10		11
	r/w	15		12
	r/w	20		13
	r/w	25		14
	r/w	30		15
	r/w	35		16
	r/w	40		17
	r/w	45		18
4096=10V	r/w	0		39
1/819	r/w	819		40
	r/w	1		41
4096=10V	r/w	0		42
1/819	r/w	819		43
	r/w	2		44
4096=10V	r/w	0		45
1/819	r/w	819		46
	r/w	3		47
4096=10V	r/w	0		48
1/819	r/w	819		49
	r/w	4		50
4096=10V	r/w	0		51
1/819	r/w	819		52
	r/w	9		53
4096=10V	r/w	0		54
1/819	r/w	819		55
	r/w	16		56
	r/w	100		57
	r/w	3473		58
	r/w	4541		59
	r/w *	5118	R310	60
	r/w *	5118	R310	61
	r/w *	5118	R310	62
	r/w	16399		63
	r/w	127		64
	r/w	504		66
	r			68
	r			69
	r			70
	r/w	0		72
h	r			74
°C	r/w	80		76
kWh	r			99
	r			105
	r			106
	r			107
	r			108
	r			109
	r			110
	r			121
	r			123
	r			124
	r/w	1709		126
%	r/w	9		127

#### 4. Acyclic parameter table Thyo-Step Controller

Table D: TSC parameters slot 1-8

Controller parameter					
Index	Symbol	Name	Data type	Value range	Combo-opt.
1	W1_TYP	Type value transformer 1	u16	1...65535	
2	W2_TYP	Type value transformer 2	u16	1...65535	
3	W3_TYP	Type value transformer 3	u16	1...65535	
4	W_CTRL	Transformer setting	u16	0...65535	
5	U_TYP	Type value U network	u16	1...260	bit coded
8	ANZ	Number	u16	1...11	
9	S01	1st phase	u16	1...32768	
10	S02	2nd phase	u16	1...32768	
11	S03	3rd phase	u16	1...32768	
12	S04	4th phase	u16	1...32768	
13	S05	5th phase	u16	1...32768	
14	S06	6th phase	u16	1...32768	
15	S07	7th phase	u16	1...32768	
16	S08	8th phase	u16	1...32768	
17	S09	9th phase	u16	1...32768	
18	S10	10th phase	u16	1...32768	
27		Setpoint activation 1	u16	0...3	bit0=1 setpoint x6.1 active, bit1=1 setpoint master active
31		Control start setpoint 1	u16	0...4096	
32		Control stop setpoint 1	u16	0...4096	
37		Control start setpoint 2	u16	0...4096	
38		Control stop setpoint 2	u16	0...4096	
39	DAC1_OF	Offset 1	u16	0...4095	
40	DAC1_FA	Scale end value 1	u16	0...4096	
41	DAC1_CTRL	Output value 1	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
42	DAC2_OF	Offset 2	u16	0...4095	
43	DAC2_FA	Scale end value 2	u16	0...4096	
44	DAC2_CTRL	Output value 2	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
45	DAC3_OF	Offset 3	u16	0...4095	
46	DAC3_FA	Scale end value 3	u16	0...4096	
47	DAC3_CTRL	Output value 3	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
48	DAC4_OF	Offset 4	u16	0...4095	
49	DAC4_FA	Scale end value 4	u16	0...4096	
50	DAC4_CTRL	Output value 4	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
51	DAC5_OF	Offset 5	u16	0...4095	
52	DAC5_FA	Scale end value 5	u16	0...4096	
53	DAC5_CTRL	Output value 5	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
54	DAC6_OF	Offset 6	u16	0...4095	
55	DAC6_FA	Scale end value 6	u16	0...4096	
56	DAC6_CTRL	Output value 6	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
57	DAC_MITTEL	Average	u16	1...65535	
58	SPG_MIN	Lower limit mains voltage	u16	0...5120	
59	SPG_MAX	Upper limit mains voltage	u16	0...5120	
60	W1_MAX	Limit transformer 1	u16	0...8192	
61	W2_MAX	Limit transformer 2	u16	0...8192	
62	W3_MAX	Limit transformer 3	u16	0...8192	
63	WA_CTRL	Monitoring mode transformer	u16	0...65535	bit coded
64		Fault output	u16	0...65535	bit coded
66		Alarm output	u16	0...65535	bit coded
68	Vers_D	Firmware version day	u16	1...31	
69	Vers_M	Firmware version month	u16	1...12	
70	Vers_Y	Firmware version year	u16	0...9999	
72		Save	u16	0...1	off, save
74		Operating hours	f32	0...	
76	TEMP_MAX	Limiting value temperature	u16	0...255	
99		Energy	f32	0...	
105		Analog output 1	u16	0...4096	
106		Analog output 2	u16	0...4096	
107		Analog output 3	u16	0...4096	
108		Analog output 4	u16	0...4096	
109		Analog output 5	u16	0...4096	
110		Analog output 6	u16	0...4096	
119		DC input 3 (x5.10)	u16	0...4096	
121		Device number	u32	0...	
123		Serial number	u16	0...	
124		PCB number	u32	0...	
126	F_MIN_MAX	Frequency limit	u16	100...2500	
127	F_TOL	Frequency tolerance	u16	1...25	

Unit	R / W	Default	Note	Index
	r/w	100		1
	r/w	100		2
	r/w	100		3
	r/w	8		4
	r/w	230		5
	r/w *	11	S2	8
	r/w *	2978		9
	r/w *	5956		10
	r/w *	8934		11
	r/w *	11912		12
	r/w *	14890		13
	r/w *	17868		14
	r/w *	20846		15
	r/w *	23824		16
	r/w *	26802		17
	r/w *	29780		18
	r			27
20/4096mA	r/w	0		31
20/4096mA	r/w	4096		32
20/4096mA	r/w	0		37
20/4096mA	r/w	4096		38
4096=10V	r/w	0		39
1/819	r/w	819		40
	r/w	1		41
4096=10V	r/w	0		42
1/819	r/w	819		43
	r/w	2		44
4096=10V	r/w	0		45
1/819	r/w	819		46
	r/w	3		47
4096=10V	r/w	0		48
1/819	r/w	819		49
	r	4		50
4096=10V	r/w	0		51
1/819	r/w	819		52
	r/w	9		53
4096=10V	r/w	0		54
1/819	r/w	819		55
	r/w	16		56
	r/w	100		57
	r/w	3473		58
	r/w	4541		59
	r/w *	5118	R310	60
	r/w *	5118	R310	61
	r/w *	5118	R310	62
	r/w	16399		63
	r/w	127		64
	r/w	504		66
	r			68
	r			69
	r			70
	r/w	0		72
h	r			74
°C	r/w	80		76
kWh	r			99
	r			105
	r			106
	r			107
	r			108
	r			109
	r			110
4096=100%	r			119
	r			121
	r			123
	r			124
	r/w	1709		126
%	r/w	9		127

## 5. Acyclic parameter table Thyo-Measurement Unit

Table D: TMU parameters slot 1-8

Controller parameter					
Index	Symbol	Name	Data type	Value range	Combo-opt.
1	W1_TYP	Type value transformer 1	u16	1...65535	
2	W2_TYP	Type value transformer 2	u16	1...65535	
3	W3_TYP	Type value transformer 3	u16	1...65535	
4	W_CTRL	Transformer setting	u16	0...65535	bit coded
5	U_TYP	Type value U network	u16	1...260	
7	T0	Measuring and cycle time	u16	1...1500	
39	DAC1_OF	Offset 1	u16	0...4095	
40	DAC1_FA	Scale end value 1	u16	0...4096	
41	DAC1_CTRL	Output value 1	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
42	DAC2_OF	Offset 2	u16	0...4095	
43	DAC2_FA	Scale end value 2	u16	0...4096	
44	DAC2_CTRL	Output value 2	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
45	DAC3_OF	Offset 3	u16	0...4095	
46	DAC3_FA	Scale end value 3	u16	0...4096	
47	DAC3_CTRL	Output value 3	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
48	DAC4_OF	Offset 4	u16	0...4095	
49	DAC4_FA	Scale end value 4	u16	0...4096	
50	DAC4_CTRL	Output value 4	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
51	DAC5_OF	Offset 5	u16	0...4095	
52	DAC5_FA	Scale end value 5	u16	0...4096	
53	DAC5_CTRL	Output value 5	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
54	DAC6_OF	Offset 6	u16	0...4095	
55	DAC6_FA	Scale end value 6	u16	0...4096	
56	DAC6_CTRL	Output value 6	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
57	DAC_MITTEL	Average	u16	1...65535	
58	SPG_MIN	Lower limit mains voltage	u16	0...5120	
59	SPG_MAX	Upper limit mains voltage	u16	0...5120	
60	W1_MAX	Limit transformer 1	u16	0...8192	
61	W2_MAX	Limit transformer 2	u16	0...8192	
62	W3_MAX	Limit transformer 3	u16	0...8192	
63	WA_CTRL	Monitoring mode transformer	u16	0...65535	bit coded
64		Fault output	u16	0...65535	bit coded
66		Alarm output	u16	0...65535	bit coded
68	Vers_D	Firmware version day	u16	1...31	
69	Vers_M	Firmware version month	u16	1...12	
70	Vers_Y	Firmware version year	u16	0...9999	
72		Save	u16	0...1	off, save
74		Operating hours	f32	0...	
76	TEMP_MAX	Limiting value temperature	u16	0...255	
99		Energy	f32	0...	
105		Analog output 1	u16	0...4096	
106		Analog output 2	u16	0...4096	
107		Analog output 3	u16	0...4096	
108		Analog output 4	u16	0...4096	
109		Analog output 5	u16	0...4096	
110		Analog output 6	u16	0...4096	
119		DC input 3 (x5.10)	u16	0...4096	
121		Device number	u32	0...	
123		Serial number	u16	0...	
124		PCB number	u32	0...	
126	F_MIN_MAX	Frequency limit	u16	100...2500	
127	F_TOL	Frequency tolerance	u16	1...25	

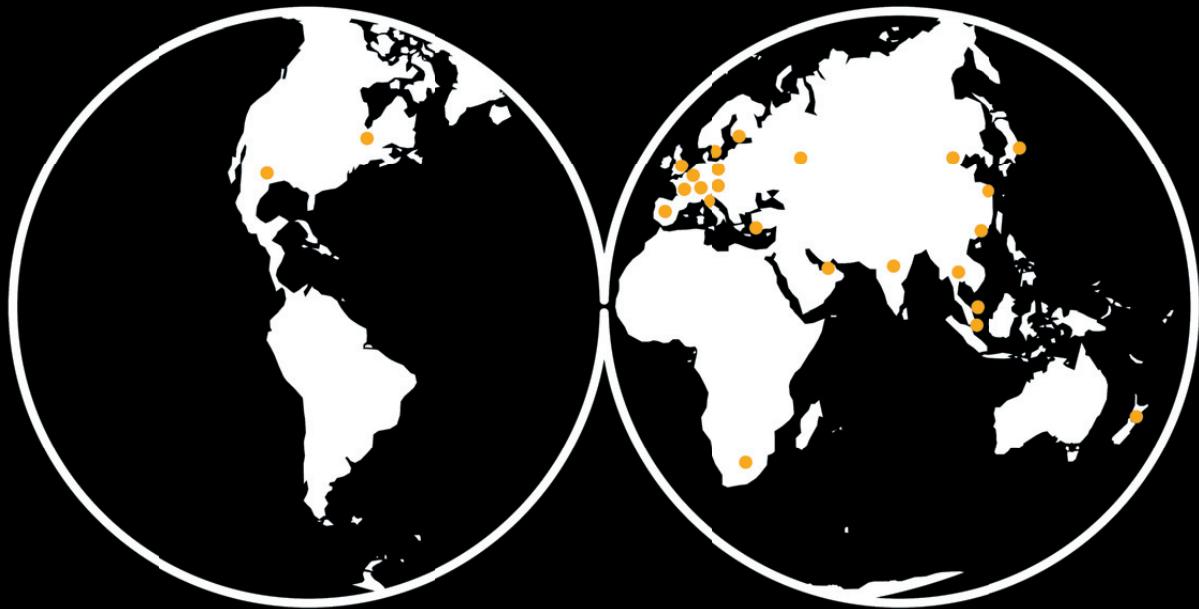
Unit	R / W	Default	Note	Index
	r/w	100		1
	r/w	100		2
	r/w	100		3
	r/w	8		4
	r/w	230		5
	r/w *	50	R309	7
4096=10V	r/w	0		39
1/819	r/w	819		40
	r/w	1		41
4096=10V	r/w	0		42
1/819	r/w	819		43
	r/w	2		44
4096=10V	r/w	0		45
1/819	r/w	819		46
	r/w	3		47
4096=10V	r/w	0		48
1/819	r/w	819		49
	r/w	4		50
4096=10V	r/w	0		51
1/819	r/w	819		52
	r/w	9		53
4096=10V	r/w	0		54
1/819	r/w	819		55
	r/w	16		56
	r/w	100		57
	r/w	3473		58
	r/w	4541		59
	r/w *	5118	R310	60
	r/w *	5118	R310	61
	r/w *	5118	R310	62
	r/w	16399		63
	r/w	127		64
	r/w	504		66
	r			68
	r			69
	r			70
h	r/w	0		72
°C	r/w	80		76
kWh	r			99
	r			105
	r			106
	r			107
	r			108
	r			109
	r			110
4096=100%	r			119
	r			121
	r			123
	r			124
%	r/w	1709		126
%	r/w	9		127

## 6. Acyclic parameter table Thyo Input-Output Unit

Table F: TIO parameters slot 1-8

Controller parameter		Name	Data type	Value range	Combo-opt.
Index	Symbol				
1	W1_TYP	Type value transformer 1	u16	1...65535	
2	W2_TYP	Type value transformer 2	u16	1...65535	
3	W3_TYP	Type value transformer 3	u16	1...65535	
4	W_CTRL	Transformer setting	u16	0...65535	bit coded
5	U_TYP	Type value U mains	u16	1...260	
7	T0	Measuring and cycle time	u16	1...1500	
39	DAC1_OF	Offset 1	u16	0...4095	
40	DAC1_FA	Scale end value 1	u16	0...4096	
41	DAC1_CTRL	Output value 1	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
42	DAC2_OF	Offset 2	u16	0...4095	
43	DAC2_FA	Scale end value 2	u16	0...4096	
44	DAC2_CTRL	Output value 2	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
45	DAC3_OF	Offset 3	u16	0...4095	
46	DAC3_FA	Scale end value 3	u16	0...4096	
47	DAC3_CTRL	Output value 3	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
48	DAC4_OF	Offset 4	u16	0...4095	
49	DAC4_FA	Scale end value 4	u16	0...4096	
50	DAC4_CTRL	Output value 4	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
51	DAC5_OF	Offset 5	u16	0...4095	
52	DAC5_FA	Scale end value 5	u16	0...4096	
53	DAC5_CTRL	Output value 5	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
54	DAC6_OF	Offset 6	u16	0...4095	
55	DAC6_FA	Scale end value 6	u16	0...4096	
56	DAC6_CTRL	Output value 6	u16	1...16	transformer1, transformer2, transformer3, U mains, setpoint1, setpoint2, R309, R310, temp., res., controller1,..., controller6
57	DAC_MITTEL	Average	u16	1...65535	
58	SPG_MIN	Lower limit mains voltage	u16	0...5120	
59	SPG_MAX	Upper limit mains voltage	u16	0...5120	
60	W1_MAX	Limit transformer 1	u16	0...8192	
61	W2_MAX	Limit transformer 2	u16	0...8192	
62	W3_MAX	Limit transformer 3	u16	0...8192	
63	WA_CTRL	Monitoring mode transformer	u16	0...65535	bit coded
64		Fault output	u16	0...65535	bit coded
66		Alarm output	u16	0...65535	bit coded
68	Vers_D	Firmware version day	u16	1...31	
69	Vers_M	Firmware version month	u16	1...12	
70	Vers_Y	Firmware version year	u16	0...9999	
72		Save	u16	0...1	off, save
74		Operating hours	f32	0...	
76	TEMP_MAX	Limiting value temperature	u16	0...255	
99		Energy	f32	0...	
105		Analog output 1	u16	0...4096	
106		Analog output 2	u16	0...4096	
107		Analog output 3	u16	0...4096	
108		Analog output 4	u16	0...4096	
109		Analog output 5	u16	0...4096	
110		Analog output 6	u16	0...4096	
119		DC input 3 (x5.10)	u16	0...4096	
121		Device number	u32	0...	
123		Serial number	u16	0...	
124		PCB number	u32	0...	
126	F_MIN_MAX	Frequency limit	u16	100...2500	
127	F_TOL	Frequency tolerance	u16	1...25	

Unit	R / W	Default	Note	Index
	r/w	100		1
	r/w	100		2
	r/w	100		3
	r/w	8		4
	r/w	230		5
	r/w *	50	R309	7
4096=10V	r/w	0		39
1/819	r/w	819		40
	r/w	1		41
4096=10V	r/w	0		42
1/819	r/w	819		43
	r/w	2		44
4096=10V	r/w	0		45
1/819	r/w	819		46
	r/w	3		47
4096=10V	r/w	0		48
1/819	r/w	819		49
	r/w	4		50
4096=10V	r/w	0		51
1/819	r/w	819		52
	r/w	9		53
4096=10V	r/w	0		54
1/819	r/w	819		55
	r/w	16		56
	r/w	100		57
	r/w	3473		58
	r/w	4541		59
	r/w *	5118	R310	60
	r/w *	5118	R310	61
	r/w *	5118	R310	62
	r/w	16399		63
	r/w	127		64
	r/w	504		66
	r			68
	r			69
	r			70
	r/w	0		72
h	r			74
°C	r/w	80		76
kWh	r			99
	r			105
	r			106
	r			107
	r			108
	r			109
	r			110
4096=100%	r			119
	r			121
	r			123
	r			124
	r/w	1709		126
%	r/w	9		127



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